CLAIMS

1.   An image processing method, comprising:

an inputting step of inputting an image data which is obtained by imaging a subject for a predetermined period of time with a medical imaging apparatus and is
5   arranged in time series;

an extracting along a time axis step of extracting pixels which satisfy a predetermined condition along a time axis from all the pixels arranged in time series for each pixel coordinate position with respect to each pixel in the image data; and

a constructing step of constructing a two-dimensional or three-dimensional
10   image based on the pixels extracted along the time axis in the extracting along the time axis step.

2.   The image processing method according to claim 1, further comprising:

an image reconstructing step of reconstructing a two-dimensional or three-dimensional image which corresponds to a two-dimensional or three-dimensional
15   range of the subject based on the image data; and

a region of interest setting step of setting at least one region of interest for the two-dimensional or three-dimensional image,

wherein the extracting along the time axis step comprises extracting pixels which satisfy a predetermined condition along the time axis from all the pixels arranged
20   in time series for each pixel coordinate position for each pixel constituting the region of interest.

3.   The image processing method according to claim 1 or claim 2, wherein the predetermined condition is to extract a pixel having a maximum pixel value along the time axis from all the pixels arranged in time series at each pixel coordinate position.

25   4.   The image processing method according to claim 1 or claim 2, wherein the predetermined condition is to extract a pixel having an arbitrary pixel value among pixel values corresponding to each pixel arranged in time series at each pixel coordinate position along the time axis.

5.   The image processing method according to any one of claims 1 to 4, wherein the extracting along the time axis step comprises: sequentially comparing a pixel value at a first time in the predetermined period of time with a pixel value at a second time in the predetermined period of time for each pixel coordinate position with respect to each · pixel in the image data along the time series; and extracting pixels which satisfy a predetermined condition along the time axis.

6.   The image processing method according to any one of claims 1 to 4, wherein the extracting along the time axis step comprises: a filtering process along the time axis to perform a predetermined filtering process on all the pixels arranged in time series for each pixel coordinate position along the time axis and obtain pixels representing each pixel coordinate position.

7.   The image processing method according to any one of claims 1, 2, 5 or 6, wherein

the extracting along the time axis step comprises: a first extracting along the time axis step of extracting a pixel having a first characteristic from all the pixels arranged in time series for each pixel coordinate position along the time axis; and a second extracting along the time axis step of extracting a pixel having a second characteristic from all the pixels arranged in time series along the time axis, and

the constructing step comprises: a first constructing step of constructing a first image based on the pixel having the first characteristic; and a second constructing step of constructing a second image based on the pixel having the second characteristic, and

the image processing method further comprises: a difference operation step of performing a difference operation on the first image and the second image; and a difference image producing step of producing a difference image based on the result of the difference operation.

8.   The image processing method according to claim 7, wherein the pixel having the first characteristic is the maximum pixel value in the pixel values of all the pixels arranged in time series at each pixel coordinate position, and the pixel having the second

characteristic is the minimum pixel value in the pixel values of all the pixels arranged in time series at each pixel coordinate position.

9.   An image processing method, comprising:

an inputting step of inputting an image data obtained by imaging a subject into which a contrast medium is injected for a predetermined period of time with a medical imaging apparatus and arranged in time series;

an image reconstructing step of reconstructing three-dimensional images arranged in time series based on the image data;

an extracting along the time axis step of extracting a maximum value pixel which has a clearest contrasted image by the contrast medium and a minimum value pixel which has little or no residual contrast medium therein from all the pixels arranged in time series for each pixel coordinate position along the time axis with respect to each pixel constituting the three-dimensional images arranged in time series;

a constructing step of constructing a two-dimensional or three-dimensional image which has a clearest contrasted image by the contrast medium based on the maximum value pixel and a two-dimensional or three-dimensional image with no or little residual contrast medium therein based on the minimum value pixel;

a difference operation step of performing a difference operation on the two-dimensional or three-dimensional image which has a clearest contrasted image by the contrast medium and the two-dimensional or three-dimensional image with no or little residual contrast medium therein; and

a difference image producing step of producing a difference image based on the result of the difference operation.

10.   An image processing method, comprising:

an inputting step of inputting image data which is obtained by imaging a subject for a predetermined period of time with a medical imaging apparatus and is arranged in time series;

a filtering along the time axis step of performing a filtering process along the time axis on all the pixels arranged in time series for each pixel coordinate position and

perform a predetermined weighting along the time axis along the time series with respect to each pixel in the image data; and

a constructing step of constructing a two-dimensional or three-dimensional image based on the image data after the filtering process along the time axis by the

5   filtering along the time axis step.

11.   The image processing method according to claim 10, wherein

the filtering along the time axis step comprises: a first filtering step of generating a first filtering image data by performing at least one filtering process along the time axis on the image data; and a second filtering step of generating a first second

10   filtering image data by performing at least one filtering process along the time axis on the image data,

the constructing step comprises: a step of constructing a first image based on the first filtering image data; and a step of constructing a second image based on the second filtering image data, and

15   the image processing method further comprises: a difference operation step of performing a difference operation on the first image and the second image; and a difference image producing step of producing a difference image based on the result of the difference operation.

12.   An image processing method, comprising:

20   an inputting step of inputting image data which is obtained by imaging a subject for a predetermined period of time with a medical imaging apparatus and is arranged in time series;

a calculating step of calculating an amount of change between a pixel value of each pixel in the image data at a first time in a predetermined period of time and a pixel

25   value of each pixel in the image data at a second time in a predetermined period of time;

a calculating step of calculating an average value of pixel values from the first time to the second time for each pixel coordinate position with respect to each pixel in a region where the amount of change is a predetermined value or less; and

a processed image producing step of producing a processed image in which each

30   pixel in the region where the amount of change is the predetermined value or less has the

average value and each pixel in the region where the amount of change is more than the predetermined value has the pixel value of the image data.

13.   The image processing method according to claim 12, wherein each pixel in the image data is associated with at least one of a pixel value, a chromaticity value a color density value, and a lightness value.

14.   An image processing device, comprising:

an input means which inputs an image data obtained by imaging a subject for a predetermined period of time with a medical imaging apparatus and is arranged in time series;

an extracting along the time axis means which extracts pixels satisfying a predetermined condition along the time axis from all the pixels arranged in time series for each pixel coordinate position with respect to each pixel in the image data; and

a construction means which constructs a two-dimensional or three-dimensional image based on the pixel extracted along the time axis by the extracting along the time axis means.

15.   An image processing device, comprising:

an input means which inputs an image data obtained by imaging a subject into which a contrast medium is injected for a predetermined period of time with a medical imaging apparatus and arranged in time series;

an image reconstructing means reconstructs three-dimensional images arranged in time series based on the image data;

an extracting along the time axis means which extracts a maximum value pixel which has a clearest contrasted image by the contrast medium and a minimum value pixel which has little or no residual contrast medium therein from all the pixels arranged in time series for each pixel coordinate position along the time axis with respect to each pixel constituting the three-dimensional images arranged in time series;

a construction means which constructs a two-dimensional or three-dimensional image which has a clearest contrasted image by the contrast medium based on the

maximum value pixel and a two-dimensional or three-dimensional image with no or little residual contrast medium therein based on the minimum value pixel;

a difference operation means which performs a difference operation on the two-dimensional or three-dimensional image which has a clearest contrasted image by the contrast medium and the two-dimensional or three-dimensional image with no or little residual contrast medium therein; and

a difference image producing means which produces a difference image based on the result of the difference operation.

16. An image processing device, comprising:

an input means which inputs an image data which is obtained by imaging a subject for a predetermined period of time with a medical imaging apparatus and is arranged in time series;

a filtering along the time axis means which performs a filtering process along the time axis on all the pixels arranged in time series for each pixel coordinate position and perform a predetermined weighting along the time axis along the time series with respect to each pixel in the image data; and

a constructing means which constructs a two-dimensional or three-dimensional image based on the image data after the filtering process along the time axis by the filtering along the time axis means.

17. An image processing device, comprising:

an input means which inputs an image data which is obtained by imaging a subject for a predetermined period of time with a medical imaging apparatus and is arranged in time series;

a calculating means which calculates an amount of change between a pixel value of each pixel in the image data at a first time in a predetermined period of time and a pixel value of each pixel in the image data at a second time in a predetermined period of time;

a calculating means calculates an average value of pixel values from the first time to the second time for each pixel coordinate position with respect to each pixel in a region where the amount of change is a predetermined value or less; and

a processed image producing means which produces a processed image in which each pixel in the region where the amount of change is the predetermined value or less has the average value and each pixel in the region where the amount of change is more than the predetermined value has the pixel value of the image data.

5   18.   A computer aided detection, comprising:

a medical imaging apparatus which obtains an image data arranged in time series by imaging a subject for a predetermined period of time;

an operation device which constructs a two-dimensional or three-dimensional image based on the image data; and

10   a displaying device which displays an image produced by the operation device, wherein

the operation device comprises:

an input means which inputs the image data arranged in time series;

an extracting along the time axis means which extracts pixels satisfying a

15   predetermined condition along the time axis extract from all the pixels arranged in time series for each pixel coordinate position with respect to each pixel in the image data; and

a constructing means which constructs a two-dimensional or three-dimensional image based on the pixel extracted along the time axis by the extracting along the time axis means, and wherein

20   the displaying device displays the two-dimensional or three-dimensional image constructed by the constructing means.

19.   A computer aided detection, comprising:

a medical imaging apparatus which obtains an image data arranged in time series by imaging a subject for a predetermined period of time;

25   an operation device which constructs a two-dimensional or three-dimensional image based on the image data; and

a displaying device which displays an image produced by the operation device, wherein

the operation device comprises:

an input means which inputs the image data obtained by imaging a subject into which a contrast medium is injected for a predetermined period of time with a medical imaging apparatus and arranged in time series;

an image reconstructing means which reconstructs three-dimensional images arranged in time series based on the image data;

an extracting along the time axis means which extracts a maximum value pixel which has a clearest contrasted image by the contrast medium and a minimum value pixel which has little or no residual contrast medium therein from all the pixels arranged in time series for each pixel coordinate position along the time axis with respect to each pixel constituting the three-dimensional images arranged in time series;

a constructing means which constructs a two-dimensional or three-dimensional image which has a clearest contrasted image by the contrast medium based on the maximum value pixel and a two-dimensional or three-dimensional image with no or little residual contrast medium therein based on the minimum value pixel;

a difference operation means which performs a difference operation on the two-dimensional or three-dimensional image which has a clearest contrasted image by the contrast medium and the two-dimensional or three-dimensional image with no or little residual contrast medium therein; and

a difference image producing means which produces a difference image based on the result of the difference operation, and wherein

the displaying device displays the difference image produced by the difference image producing means.

20.   A computer aided detection, comprising:

a medical imaging apparatus which obtains an image data arranged in time series by imaging a subject for a predetermined period of time;

an operation device which constructs a two-dimensional or three-dimensional image based on the image data; and

a displaying device which displays an image produced by the operation device, wherein the operation device comprises:

an input means which inputs the image data arranged in time series;

a filtering along the time axis means which performs a filtering process along the time axis and performs a predetermined weighting along the time axis along the time series on all the pixels arranged in time series for each pixel coordinate position with respect to each pixel in the image data; and

5 a constructing means which constructs a two-dimensional or three-dimensional image based on the image data after the filtering process along the time axis by the filtering along the time axis means, and

wherein the displaying device displays the two-dimensional or three-dimensional image constructed by the constructing means.

10 21. A filtering method along the time axis, comprising:

an inputting step of inputting an image data which is obtained by imaging a subject for a predetermined period of time with a medical imaging apparatus and is arranged in time series; and

a filtering along the time axis step of performing a filtering process along the 15 time axis on all the pixels arranged in time series for each pixel coordinate position and perform a predetermined weighting along the time axis along the time series with respect to each pixel in the image data.

22. A filtering method along the time axis, comprising:

an inputting step of inputting an image data which is obtained by imaging a 20 subject for a predetermined period of time with a medical imaging apparatus and is arranged in time series; and

a filtering along the time axis step of performing a filtering process along the time axis on all the pixels arranged in time series for each pixel coordinate position with respect to each pixel in the image data to obtain a pixel value which represents each pixel 25 coordinate position.

23. The filtering method along the time axis according to claim 22, wherein the filtering process along the time axis calculates the sum average of a pixel value in the image data at a time of interest in the predetermined period of time, a pixel value of the image data at a time before the time of interest, and a pixel value of the image data at a

time after the time of interest, and outputs the sum average value as a result of the filtering process along the time axis.

24. The filtering method along the time axis according to claim 22, wherein the filtering process along the time axis multiplies a predetermined weighted coefficient by a pixel value of the image data at a time of interest in the predetermined period of time, a pixel value of the image data at a time before the time of interest, and a pixel value of the image data at a time after the time of interest, calculates a weighted sum average value based on the pixel value after the multiplication, and outputs the weighted sum average value as a result of the filtering process along the time axis.

25. The filtering method along the time axis according to claim 22, wherein the filtering process along the time axis outputs a pixel value which is the median when all the pixels in a predetermined period of time are arranged sequentially from the smallest to the largest as a result of the filtering process along the time axis.

26. The filtering method along the time axis according to claim 22, wherein the filtering process along the time axis calculates a difference between a pixel value of the image data at a time before a time of interest in the predetermined period of time and a pixel value of the image data at a time after the time of interest, and outputs the difference as a result of the filtering process along the time axis.

27. The filtering method along the time axis according to claim 22, wherein the filtering process along the time axis multiplies a pixel value of a pixel in the image data at a time of interest in the predetermined period of time by a predetermined positive weight coefficient, multiplies a pixel value of a pixel in the image data at a time before the time of interest and a pixel value of a pixel in the image data at a time after the time of interest by a predetermined negative weight coefficient, calculates a sum by adding the image value at the time of interest after multiplied by the predetermined positive weight coefficient and the pixel value at a time before the time of interest and the pixel value at a time after the time of interest multiplied by the predetermined negative weight coefficient, and outputs the sum as a result of the filtering process along the time axis.